

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

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1. REPORT DATE (DD-MM-YYYY)

03-09-2004

2. REPORT TYPE

Final Report

3. DATES COVERED (From - To)

09-03-2003 - 28-01-2004

4. TITLE AND SUBTITLE

NON-THERMAL PLASMA DECONTAMINATION TECHNOLOGY FOR FORWARD-DEPLOYED FORCES.

5a. CONTRACT NUMBER

N00014-03-M-0154

5b. GRANT NUMBER

N00014-03-M-0154

5c. PROGRAM ELEMENT NUMBER

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

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8. PERFORMING ORGANIZATION  
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

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Arlington, VA 22217-5000

10. SPONSOR/MONITOR'S ACRONYM(S)  
ONR

11. SPONSORING/MONITORING  
AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT

Distribution Unlimited

Approved for Public Release  
Distribution Unlimited

13. SUPPLEMENTARY NOTES

20040914 019

14. ABSTRACT

Non-thermal plasma processing is an emerging advanced oxidation technology for oxidation of hazardous microorganisms and compounds at low temperature. The plasma generated during an electrical discharge or when an energetic particle beam is injected into air produces copious free radicals. These free radicals are utilized in the chemical reactions, which normally would require very high temperature. Neutralization of chemical and biological warfare simulant agents deposited on surfaces was tested using non-thermal plasma source developed by Super Pulse. The surfaces tested varied from plastics to metal. The results show that the non-thermal plasma produced by the developed source is a very effective oxidizer.

15. SUBJECT TERMS

Free radicals, Non-thermal plasma, decontamination, electric discharge.

16. SECURITY CLASSIFICATION OF:

a. REPORT  
unclassified

b. ABSTRACT  
unclassified

c. THIS PAGE  
unclassified

17. LIMITATION OF  
ABSTRACT  
UL

18. NUMBER  
OF PAGES  
1

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## FINAL REPORT

Grant #: N00014-03-M-0154

PRINCIPAL INVESTIGATOR: Dr. Czeslaw Golkowski

INSTITUTION: SUPER PULSE

**GRANT TITLE: NON-THERMAL PLASMA DECONTAMINATION  
TECHNOLOGY FOR FORWARD-DEPLOYED FORCES.**

AWARD PERIOD: 9 March 2003 – 28 January 2004

**OBJECTIVE:** The main technical objective of Phase I was a proof-of-principle demonstration that a non-thermal plasma source developed by Super Pulse is suitable for development of a decontamination device for forward-deployed forces to fight-through and recover from a terrorist or other asymmetric attack.

**APPROACH:** Non-thermal plasma processing is an emerging advanced oxidation technology for oxidation of hazardous microorganisms and compounds at low temperature. The plasma generated during an electrical discharge or when an energetic particle beam is injected into air produces copious free radicals. These free radicals are utilized in chemical reactions, which normally would require very high temperatures. Neutralization of chemical and biological warfare simulant agents deposited on surfaces was tested using non-thermal plasma. The surfaces tested varied from plastics to metal.

**ACCOMPLISHMENTS:** Non-thermal plasma production was stable and reliable. The plasma killed (up to 100%) microorganisms (vegetative *Escherichia coli* and spores *Bacillus subtilis*) deposited on surfaces in time of seconds. A chemical simulant agent deposited on a surface was decomposed.

**CONCLUSIONS:** The results show that the non-thermal plasma produced by the developed Super Pulse source is a very effective oxidizer. The results also showed that this plasma is very effective in killing microorganisms (spores and vegetative) deposited on different surfaces. The effectiveness of chemical warfare agent neutralization also has been shown.

**SIGNIFICANCE:** Non-thermal plasma can be used in decontamination of surfaces where other decontamination methods are not feasible.

**PATENT INFORMATION:** NONE

**AWARD INFORMATION:** NONE

**PUBLICATIONS AND ABSTRACTS:** NONE

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